

Fig. 1

PHOTOELECTRIC SENSOR  
UNIT

Inventor(s): Takashi KAMEI  
DOCKET NO.: 044499-0181

Fig. 2

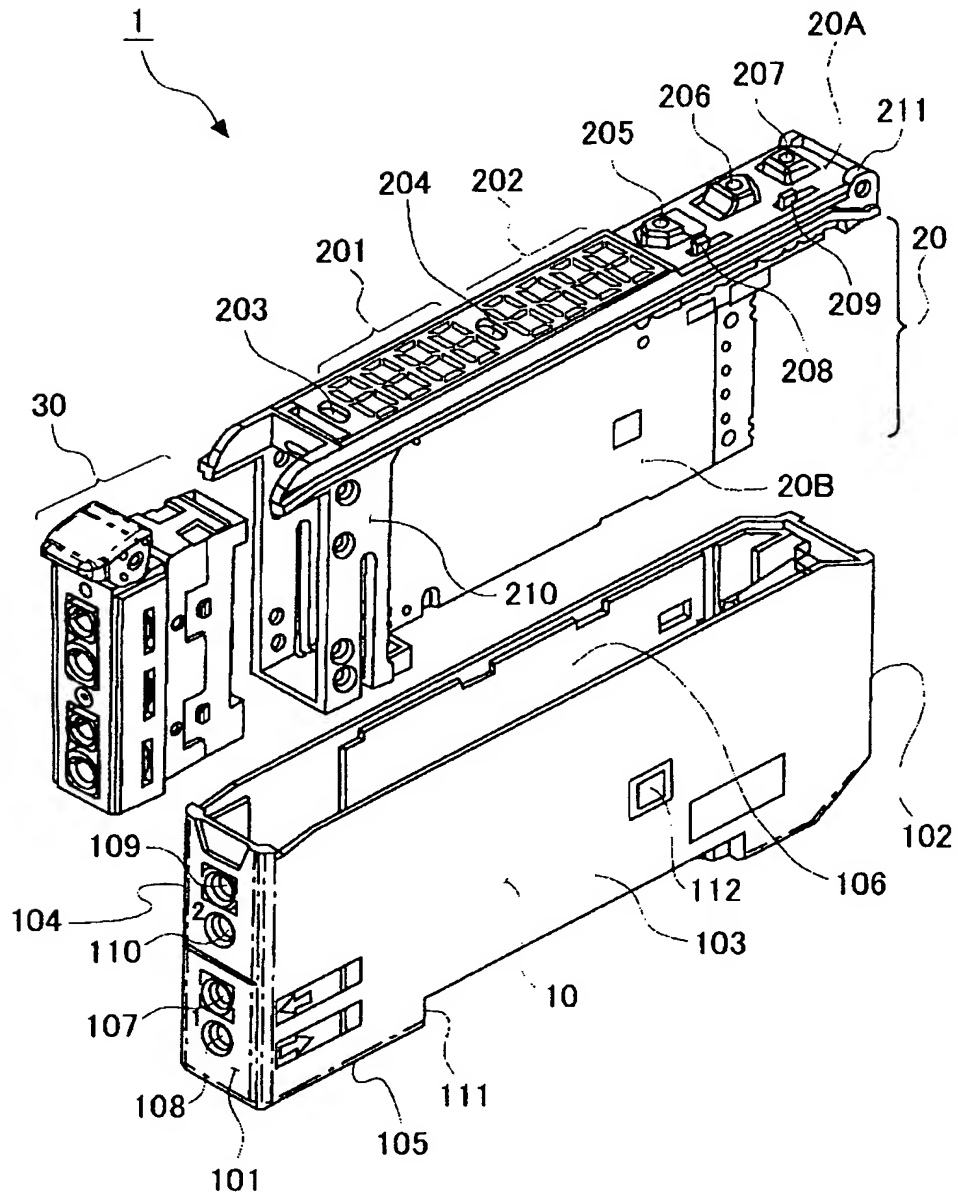
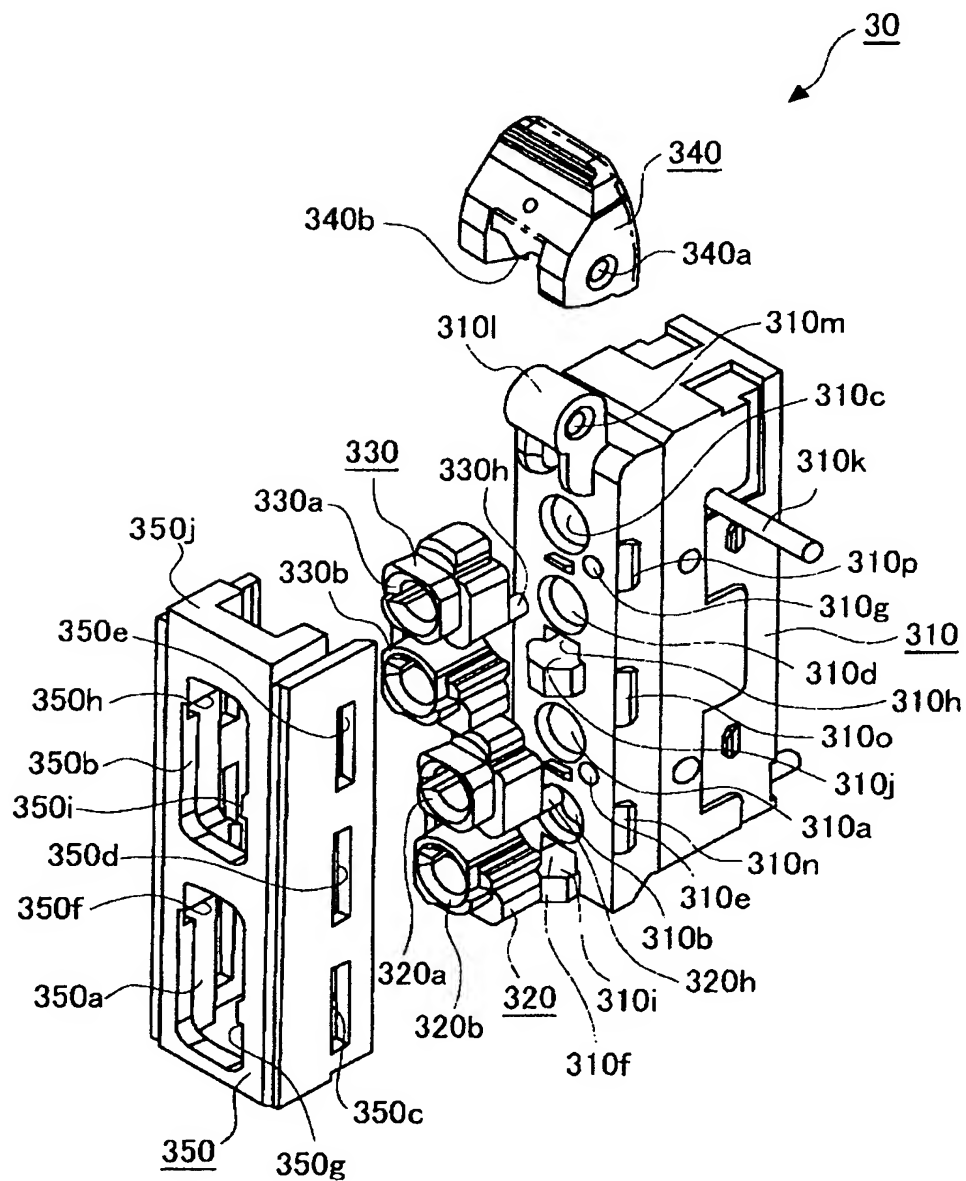


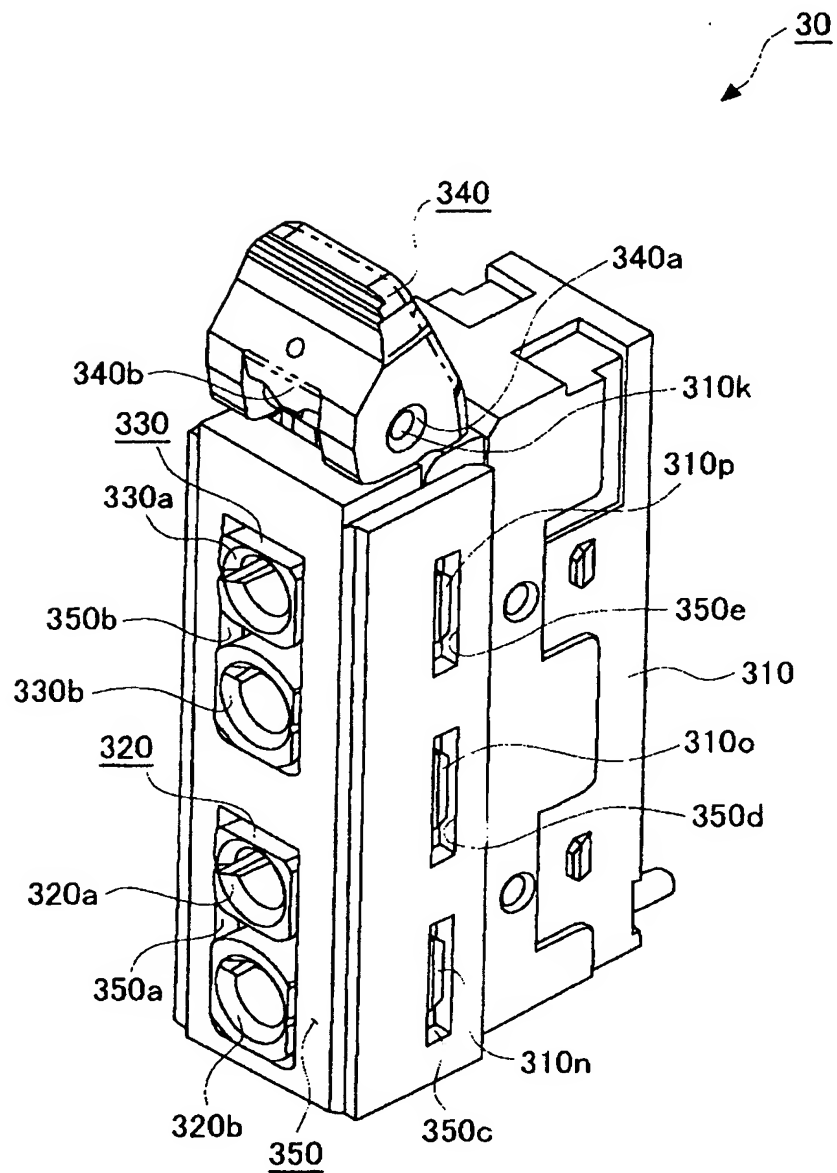
Fig. 3



Title: OPTICAL FIBER  
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Fig. 4



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Fig. 5

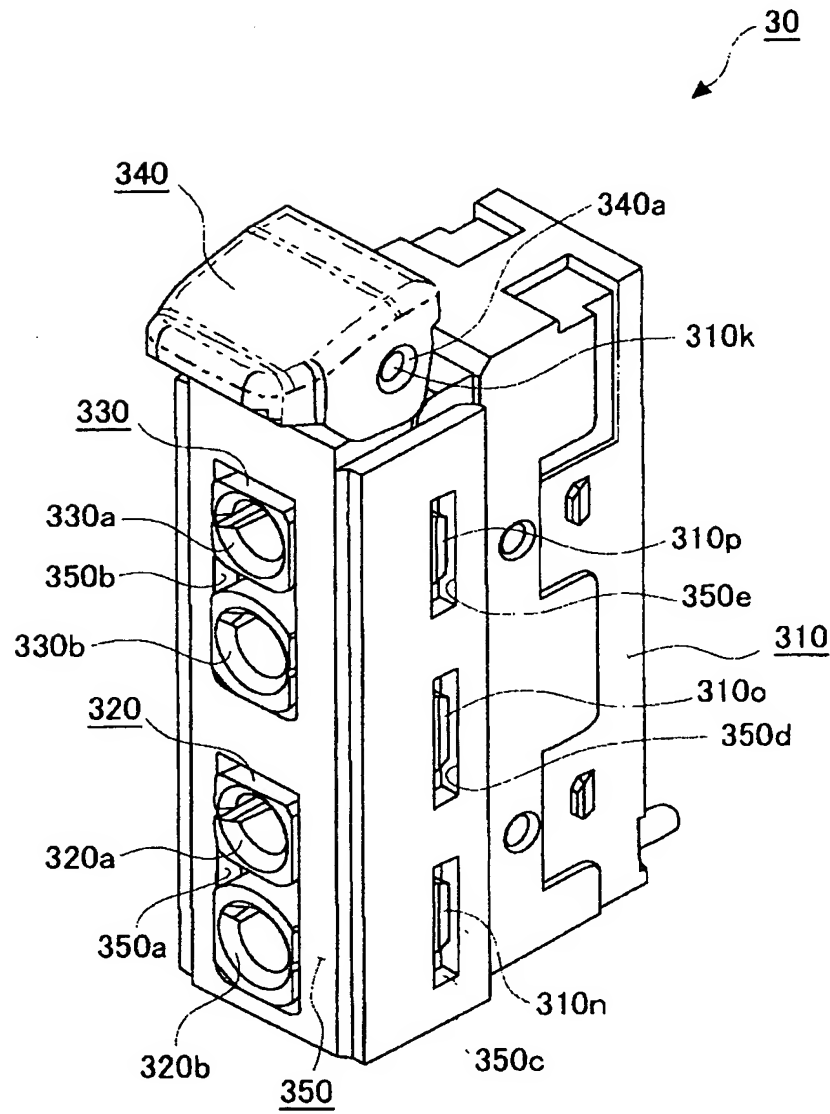
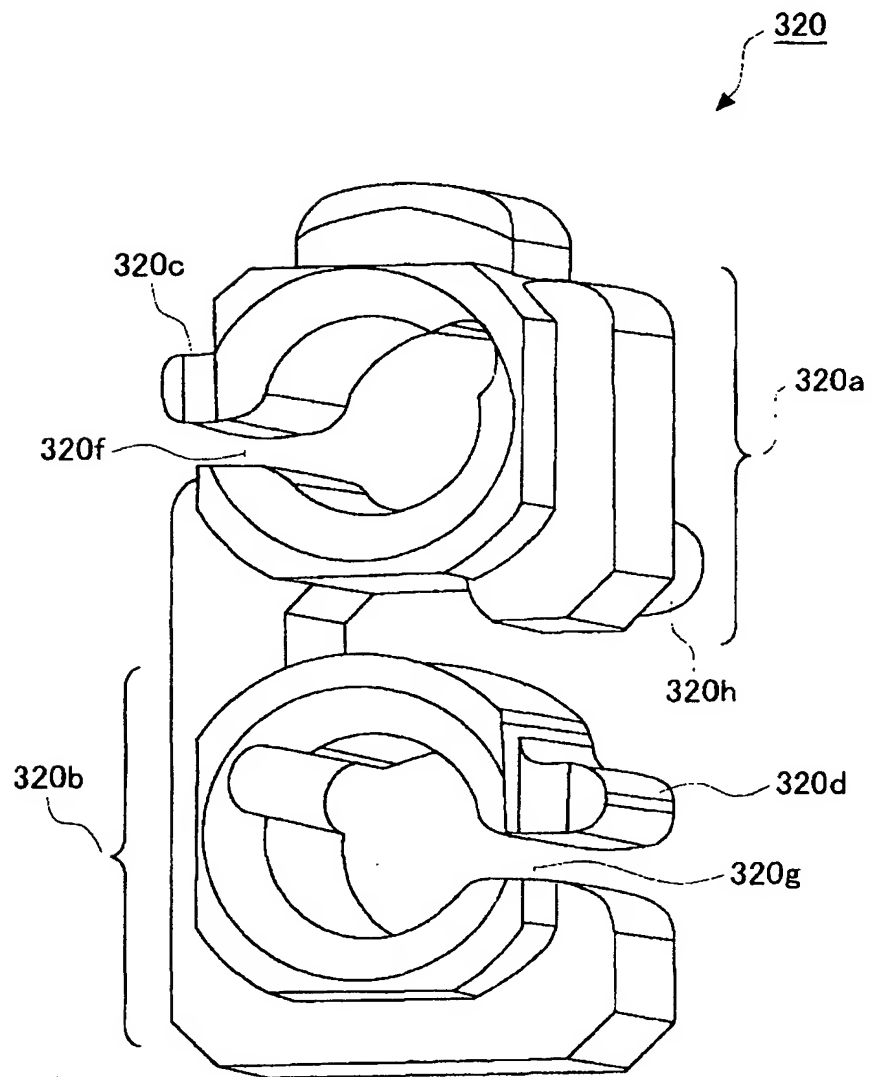


Fig. 6



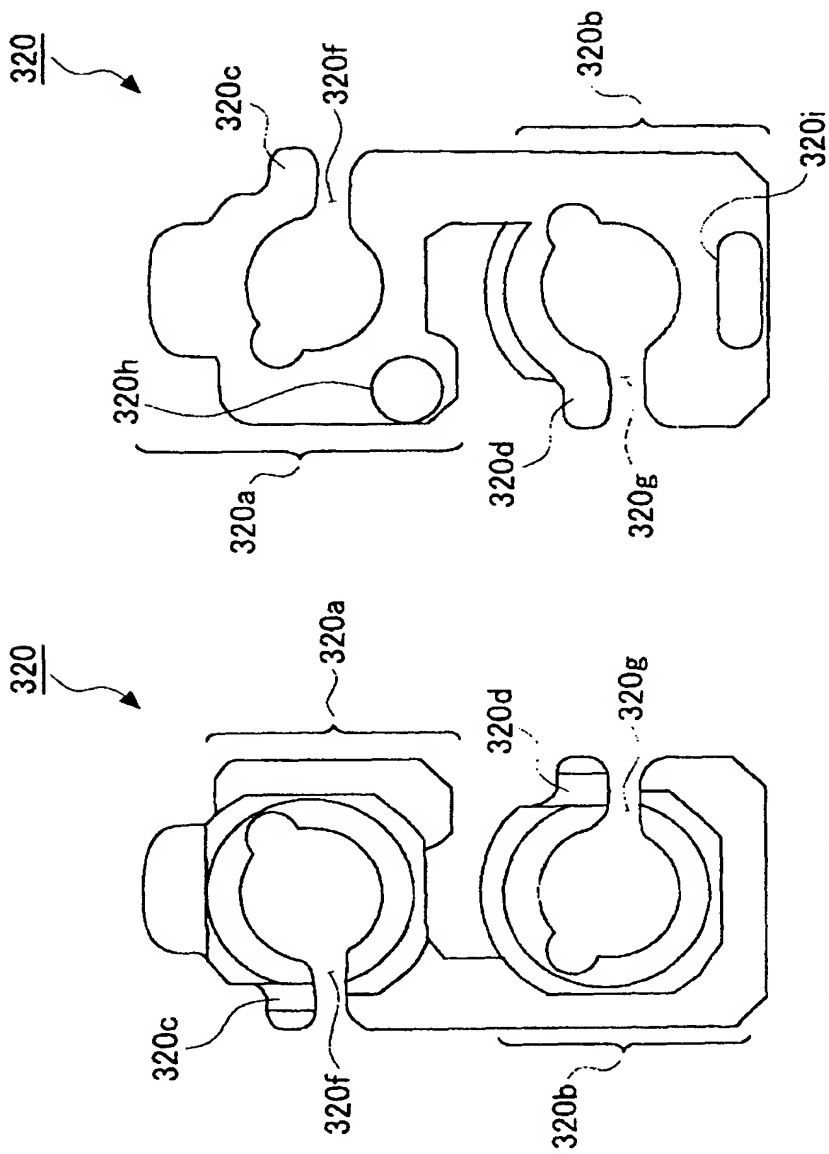


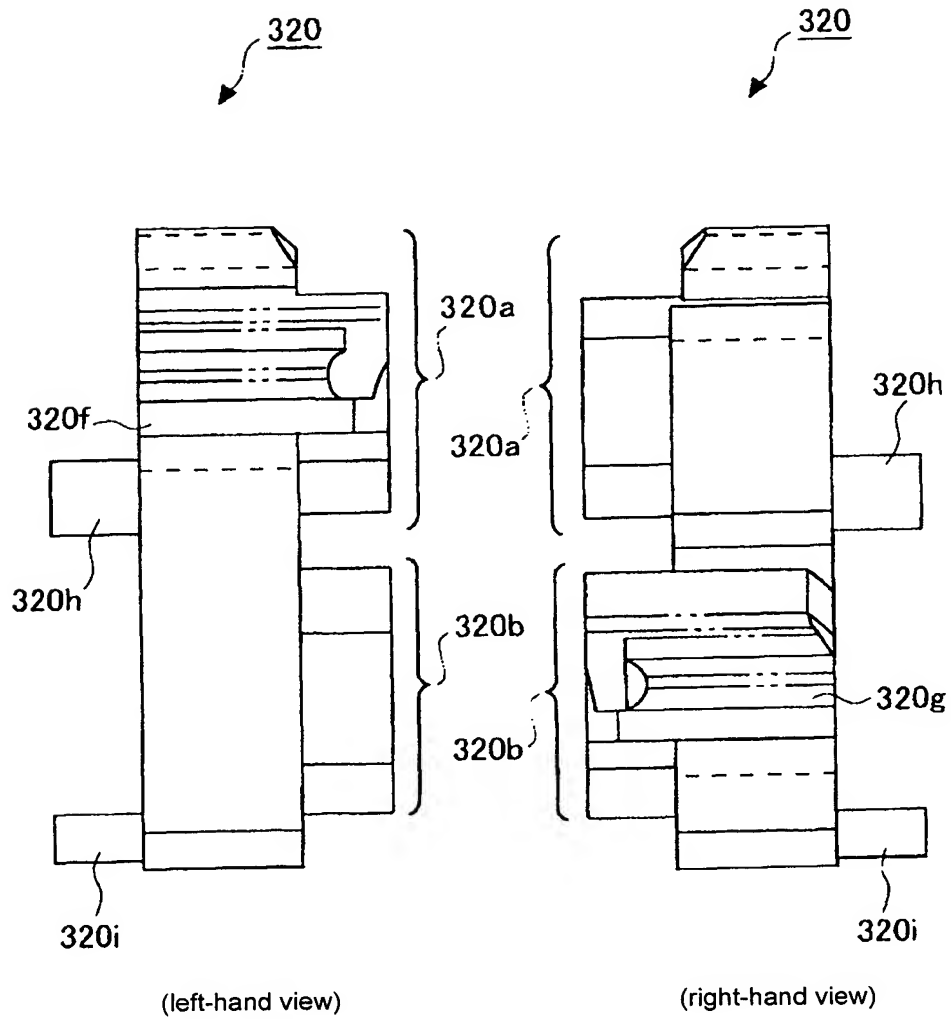
Fig. 7A front view

Fig. 7B rear view

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Fig. 8





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Fig. 9A plan view

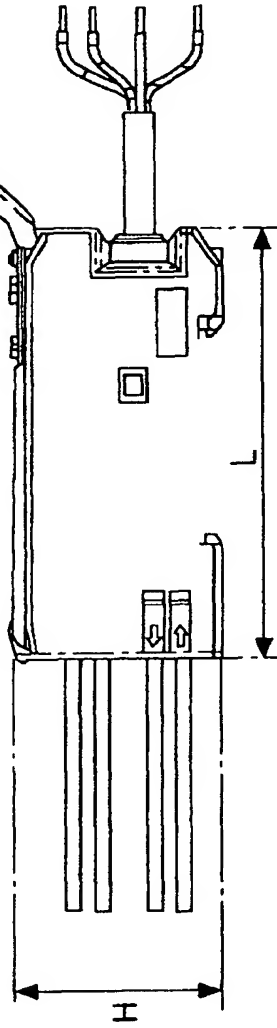
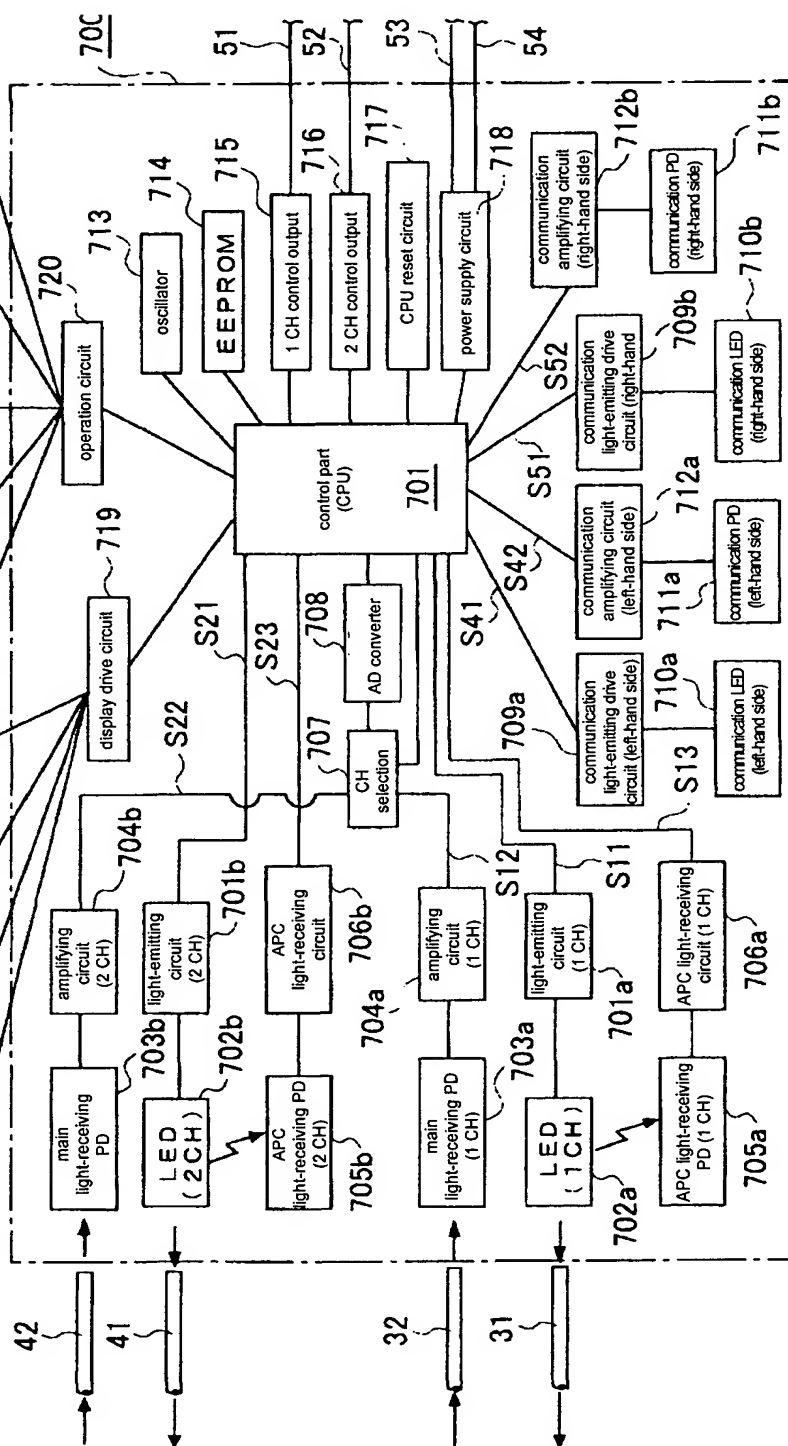


Fig. 9B right-hand view

The block diagram illustrates the internal architecture of a portable electronic device 100. The device is divided into several functional blocks:

- Input/Output Section (Top):** Includes an operation indicator light (1 CH) 203, a first digital display part 201, an operation indicator light (2 CH) 204, a second digital display 202, and a control panel 205a with UP, DOWN, and MODE buttons. A SET/RUN selection SW 208a and channel selection 209a are also present.
- Lighting Section (Bottom):** Features two sets of lighting components: a left-hand side (31) with a main light-receiving PD (1 CH) 703a, an LED (1 CH) 702a, and an APC light-receiving PD (1 CH) 705a; and a right-hand side (41) with a main light-receiving PD (2 CH) 703b, an LED (2 CH) 702b, and an APC light-receiving PD (2 CH) 705b.
- Control and Processing Section (Center):** The central control part (CPU) 701 is connected to an operation circuit 713, an oscillator 714, EEPROM 715, and control outputs for 1 CH (716) and 2 CH (717). It also manages a CPU reset circuit 718 and a power supply circuit 719.
- Display and Communication Section (Right):** Includes a display drive circuit 719, an AD converter 708, and CH selection 707. Communication is handled by communication light-emitting drive circuits (S51, S52) and communication PDs (710a, 710b) on both sides.
- Signal Paths (Left):** Indicated by arrows 32 and 42, showing signal flow between the lighting components and the central control unit.



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Fig. 11

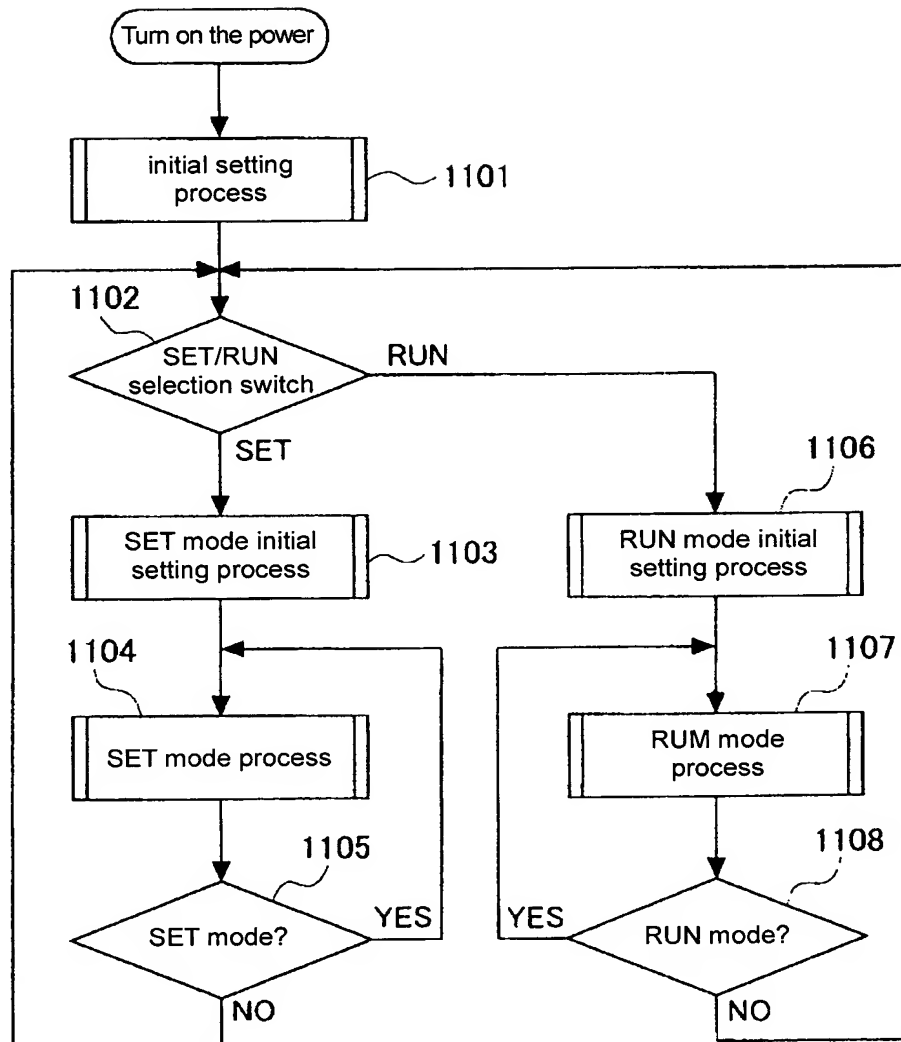
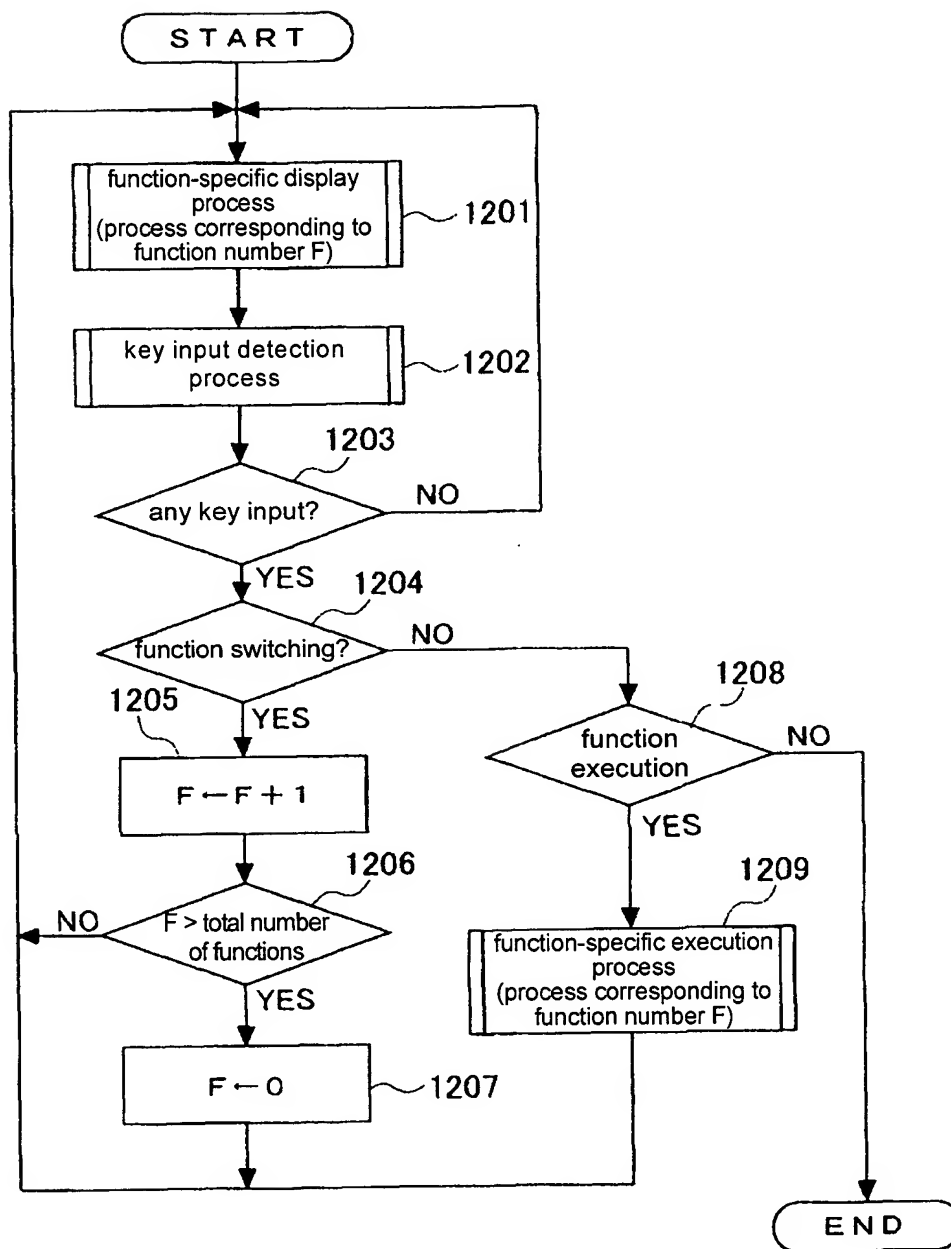


Fig. 12



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Fig. 13

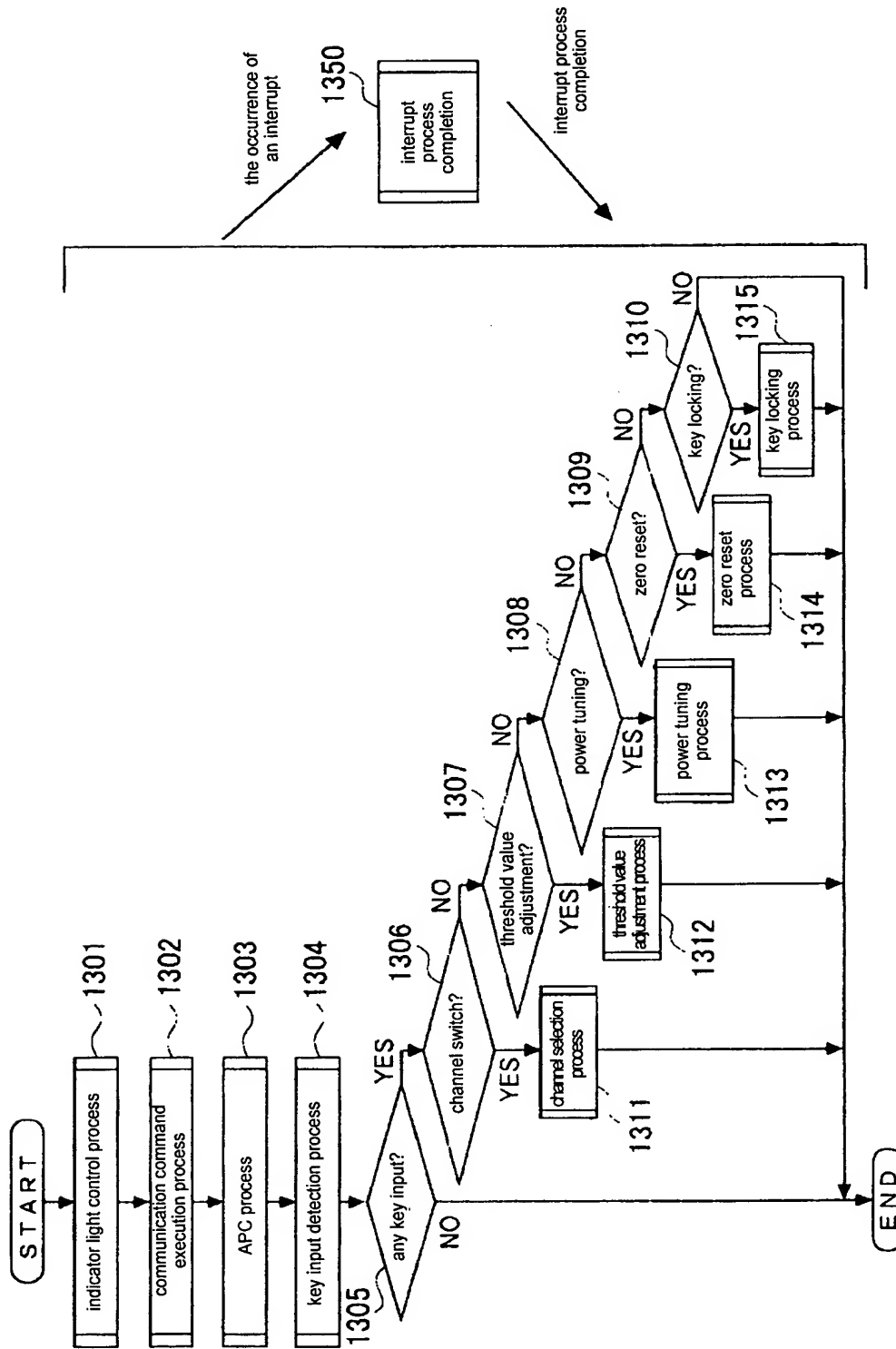
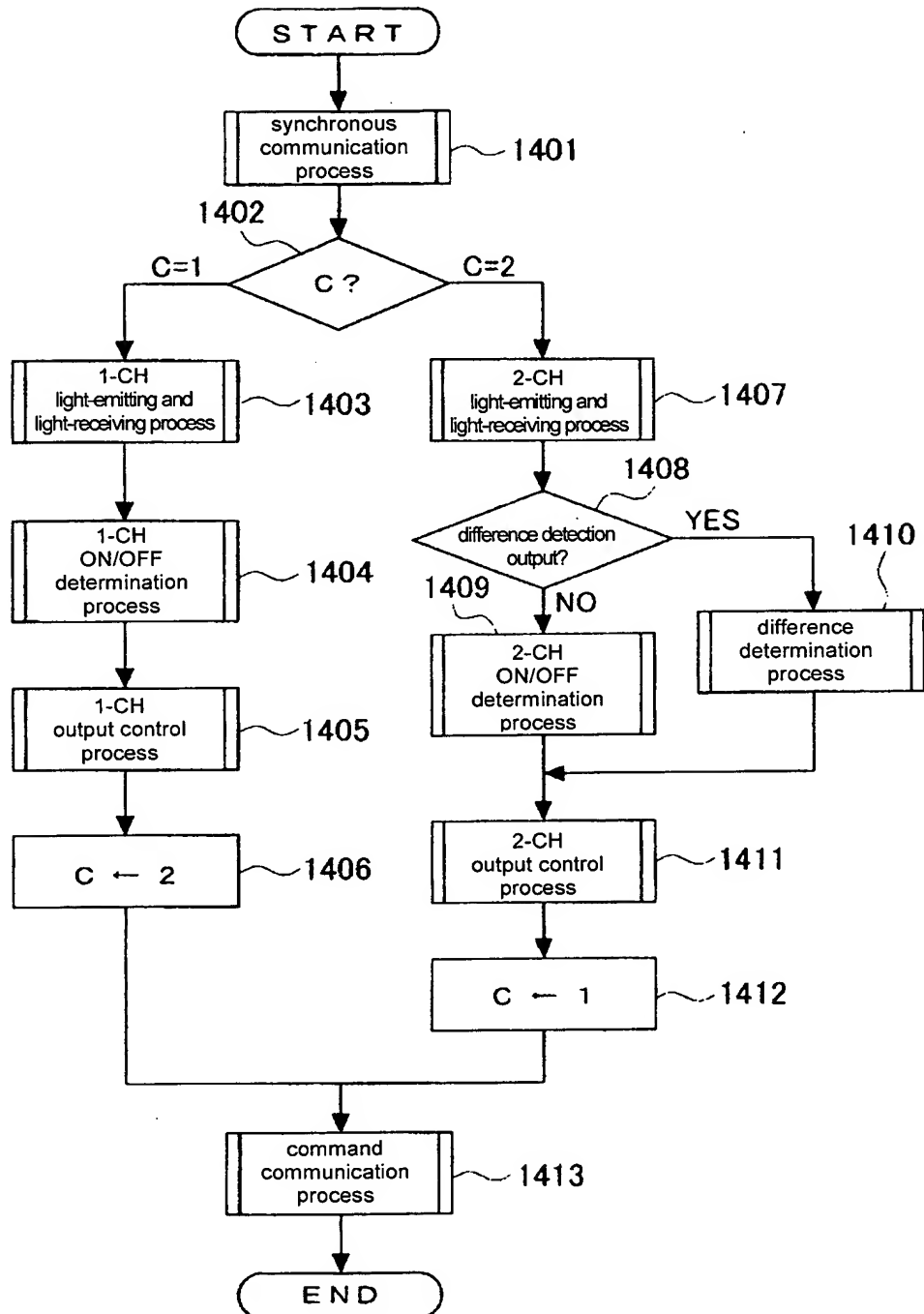


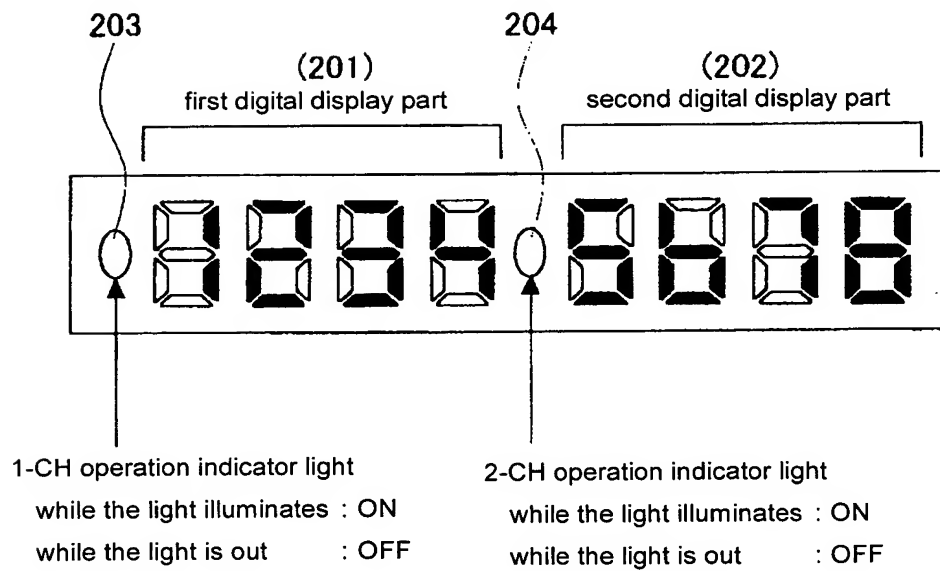
Fig. 14



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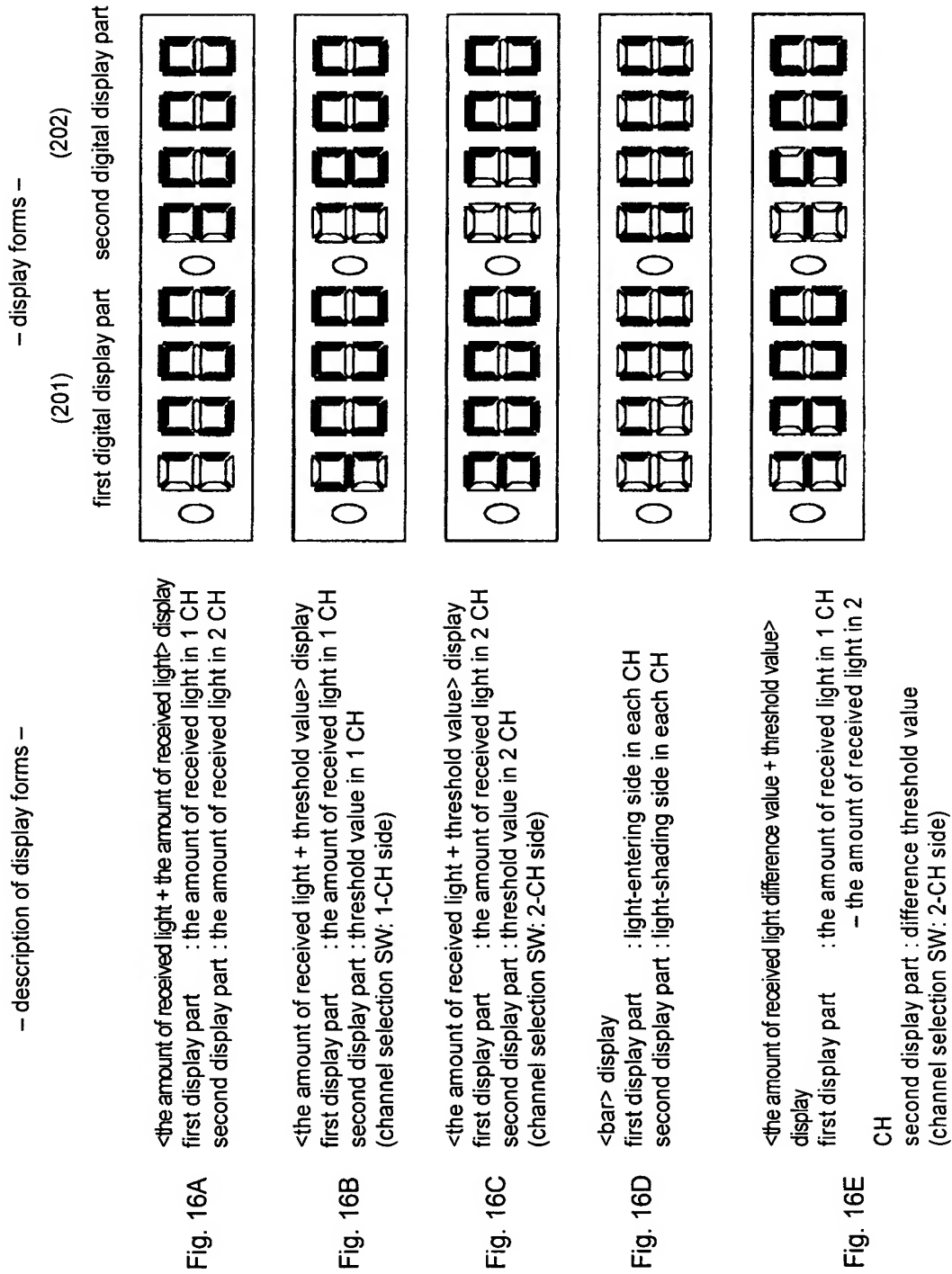
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Fig. 15



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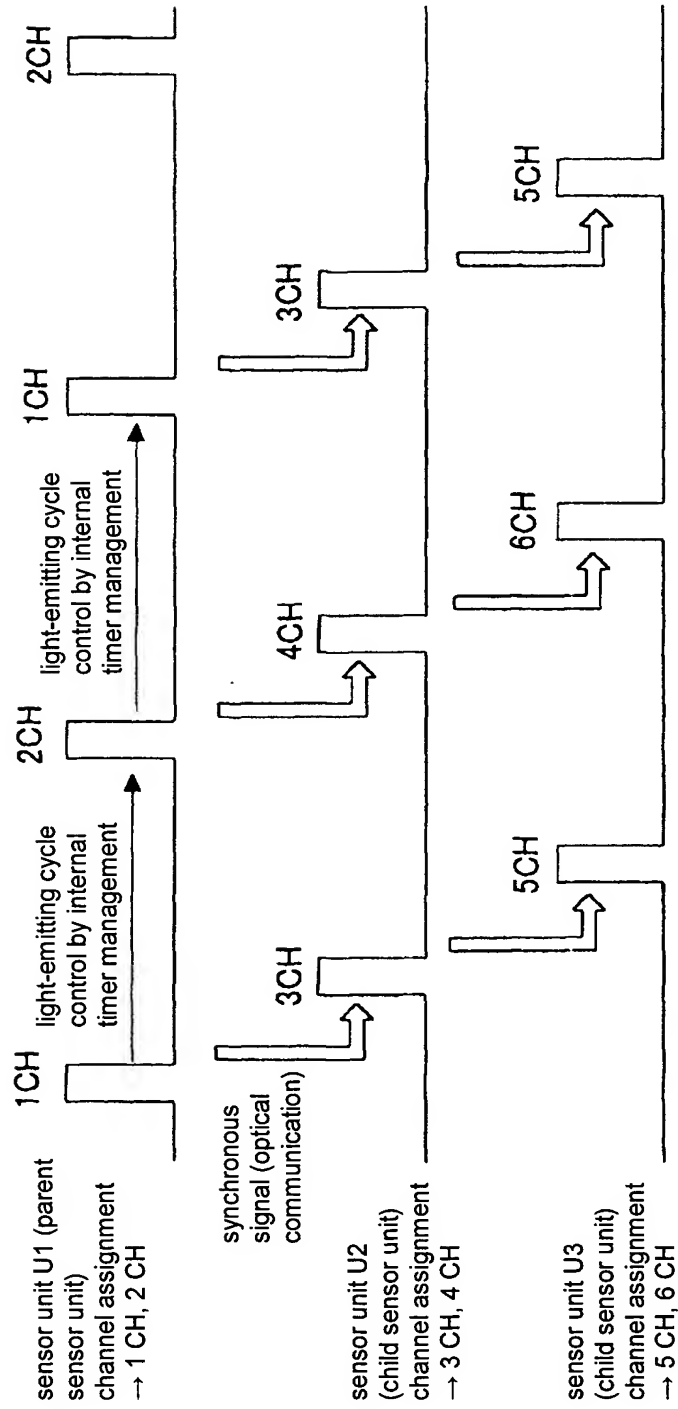




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Fig. 17



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Fig. 18

	process	process description
1	initial setting process	<ul style="list-style-type: none"><li>• The memories, indicator lights, and control outputs are initialized.</li><li>• The readout of necessary items from EEPROM and data checking are performed.</li></ul>
2	SET mode initial setting process	<ul style="list-style-type: none"><li>• The SET mode setting value is initialized.</li><li>• The function number F (F=0) is initialized.</li></ul>
3	SET mode process	<ul style="list-style-type: none"><li>• SET mode process is executed.</li></ul>
4	RUN mode initial setting process	<ul style="list-style-type: none"><li>• The indicator lights and control outputs are initialized.</li><li>• The threshold value and RUM mode setting values are initialized.</li><li>• The light-emitting and light-receiving channel number C (C=1) is initialized.</li></ul>
5	RUN mode process	<ul style="list-style-type: none"><li>• RUN mode process is executed.</li></ul>

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Fig. 19

	process	process description
1	function-specific display process	<ul style="list-style-type: none"><li>• The indicator lights are controlled and display is performed according to the set function number (F).</li></ul>
2	key input detection	<ul style="list-style-type: none"><li>• Key input detection is performed at the regular time intervals and when a key input has been detected, a setting is performed to execute the appropriate process.</li></ul>
3	function-specific execution process	<ul style="list-style-type: none"><li>• The process according to the set function number (F) is executed.</li><li>• When individual setting for each channel is possible, the state of the channel selection switch is detected and the process is applied the corresponding channel.</li></ul>

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Fig. 20

F	item	function description	the capability or incapability of the individual setting for each channel (*)
0	teaching	<ul style="list-style-type: none"> <li>Various types of teaching are performed according to the key input and a threshold value is determined.</li> </ul> [types of teaching] teaching without work, teaching with work, maximum sensitivity setting, etc.	○
1	operation mode setting	<ul style="list-style-type: none"> <li>operation mode setting is performed</li> </ul> L. ON : light-entering ON D. ON : light-shading ON	○
2	detection function setting	<ul style="list-style-type: none"> <li>the detection function is selected.</li> </ul> The detecting algorithm at the time of determining between ON and OFF differs depending the selected contents of this function. [detecting functions] standard mode, top-speed mode, high precision mode, etc.	×
3	timer function setting	<ul style="list-style-type: none"> <li>a timer mode and a timer are set.</li> </ul> Through these settings, the output timing at the time of determining between ON and OFF is set. [timer mode] timer off, off delay, on delay, one shot [time set by the timer] the time is set within the permissible range, besides the timer off.	○
4	a display content setting	<ul style="list-style-type: none"> <li>A display content is selected.</li> </ul> [display contents] the amount of received light, threshold value, bar display, etc. (*) These display contents can be displayed in combination (*) The hold value (peak, bottom, etc.) of each content is possible.	×
5	key function assignment setting	<ul style="list-style-type: none"> <li>The role of the key in the RUM mode is selected.</li> </ul> [key assignment] power tuning, zero reset, etc.	×
6	power tuning target value setting	<ul style="list-style-type: none"> <li>The target value at the execution of power tuning is set.</li> </ul>	×
7	display direction setting	<ul style="list-style-type: none"> <li>A display direction is selected.</li> </ul> normal : normal direction display reverse : reverse direction display	×
8	output content setting	<ul style="list-style-type: none"> <li>The output content of the second channel in the two-output model is set.</li> </ul> [output contents] normal independent output, AND output, OR output, difference output	×

(\*) Concerning the item which can be individually set for each channel, the process is executed only to the corresponding channel by detecting the state of the channel selection switch during the execution.

(\*) The "difference output" in the "output setting content" in F=8 is determined by "(the amount of received light in 1 CH) - (the amount of received light in 2 CH)".

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Fig. 21

	process	process description
1	indicator light control	<ul style="list-style-type: none"> <li>The illumination of the 7-segment display device is controlled according to the designated display content.</li> </ul>
2	communication command execution	<ul style="list-style-type: none"> <li>When a communication command is received in the instrumentation interrupt process, the appropriate command is processed.</li> </ul>
3	APC	<ul style="list-style-type: none"> <li>The monitoring amount of received light acquired in the instrumentation interrupt process is monitored and APC (auto power control: power control of the light-emitting current) amendment is applied at the regular time intervals.</li> <li>The amendment process is executed from channel to channel.</li> </ul>
4	key input detection	<ul style="list-style-type: none"> <li>Key input detection is performed at the regular time intervals and when a key input has been detected, a setting is performed to execute the appropriate process.</li> </ul>
5	channel switching	<ul style="list-style-type: none"> <li>A designating channel is selected according to the key input.</li> </ul>
6	threshold value adjustment	<ul style="list-style-type: none"> <li>The threshold value is changed according to the key input</li> <li>The process is applied to the designated channel.</li> </ul>
7	power tuning	<ul style="list-style-type: none"> <li>The light-emitting power and the light-receiving gain are optimized so as to acquire the target detection value (power tuning execution).</li> <li>When "power tuning release" has been requested, the light-emitting power and the light-receiving gain in default are resumed (power tuning release).</li> <li>The process is applied to the designated channel.</li> </ul>
8	zero reset	<ul style="list-style-type: none"> <li>The amount of received light at the starting point is so determined that the amount of received light display at present becomes "0". Hereafter, the amount of change from the amount of received light at the starting point is displayed as the amount of received light. The threshold value is shift-displayed in the same manner according to the amount of received light at the starting point (zero reset execution).</li> <li>When the "zero reset release" has been requested, the amount of received light display in default is resumed (zero reset release).</li> <li>The process is applied to the designated channel.</li> </ul>
9	key locking	<ul style="list-style-type: none"> <li>"key locking" is set (when "key locking" has been set, key inputs other than a specific key input are rejected).</li> <li>When "key locking release" has been requested, the locking is released.</li> </ul>

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Fig. 22

	process	process description
1	synchronous communication	<ul style="list-style-type: none"> <li>A light-emitting synchronous signal is transmitted to the adjacent sensor unit.</li> </ul>
2	1-CH light-emitting and light-receiving	<ul style="list-style-type: none"> <li>Illumination control of the 1-CH light-emitting LED is performed according to the set detection mode, and the amount of received light obtained is converted to an electric signal and amplified, and then A/D conversion is executed so as to acquire the detection value. The detection value thus obtained is used for the display in the 1-CH ON/OFF determination process or the RUN mode process.</li> </ul>
3	1-CH ON/OFF determination	<ul style="list-style-type: none"> <li>The acquired detection value is compared with the threshold level so as to perform the 1-CH ON/OFF determination according to the set detection function, timer mode and operation modes (L. ON/D. ON).</li> </ul>
4	1-CH output control	<ul style="list-style-type: none"> <li>Output control of the 1-CH control output and illumination control of the operation indicator light are performed according to the 1-CH ON/OFF condition.</li> </ul>
5	2-CH light-emitting and light-receiving	<ul style="list-style-type: none"> <li>Illumination control of the 2-CH light-emitting LED is performed according to the set detection mode, and the amount of received light obtained is converted to an electric signal and amplified, and then A/D conversion is executed so as to acquire the detection value. The detection value thus obtained is used for the display in the 2-CH ON/OFF determination process or the RUN mode process.</li> </ul>
6	2-CH ON/OFF determination	<ul style="list-style-type: none"> <li>The acquired detection value is compared with the threshold level so as to perform the 2-CH ON/OFF determination according to the set detection function, timer mode and operation modes (L. ON/D. ON).</li> </ul>
7	difference determination	<ul style="list-style-type: none"> <li>The value obtained by subtracting the amount of received light of 2 CH from the amount of received light of 1 CH is compared with the threshold level so as to perform the 2-CH ON/OFF determination according to the timer mode and operation modes (L. ON/D. ON).</li> </ul>
8	2-CH output control	<ul style="list-style-type: none"> <li>Output control of 2-CH control output and illumination control of the operation indicator light are performed according to the output content setting in the SET mode. (output content setting) <ul style="list-style-type: none"> <li>• normal independent output ... the results of the 2-CH ON/OFF determination are outputted</li> <li>• AND output ... the AND output of the results of the 1-CH ON/OFF determination and the 2-CH ON/OFF determination</li> <li>• OR output ... the OR output of the results of the 1-CH ON/OFF determination and the 2-CH ON/OFF determination</li> <li>• difference output ... it is outputted according to the results of the difference determination</li> </ul> </li> </ul>
9	command communication	<ul style="list-style-type: none"> <li>When a command communication is received through communication, the received contents are stored and the command is forwarded to the adjacent sensor unit.</li> </ul>